Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 1 and 22 of the Commission's Rules with Regard to the Cellular Service, Including Changes in Licensing of Unserved Area	)	WT Docket 12-40
	)	RM-11510
Amendment of the Commission's Rules with Regard to Relocation of Part 24 to Part 27	)	
	)	
Interim Restrictions and Procedures for Cellular Service Applications	)	

To: The Commission

Comments of Hammett & Edison, Inc., Consulting Engineers

1. This Hammett & Edison, Inc. (H&E) filing is in response to the Commission's February 15, 2012, Notice of Proposed Rulemaking (NPRM) to WT Docket 12-40, regarding changes to the Part 22, 24 and 27 Rules, plus correction of an error in Part 1 of the Commission's rules involving distance calculations. The NPRM was published in the Federal Register on March 16, 2012, giving a May 15, 2012, comment deadline. Therefore, these comments are timely filed. Our comments address only the distance calculation correction portion of the NPRM.

I. H&E Supports the Correction of the Formula Error in Section 1.958 of the Commission's Rules

2. In 1980, in the MB Docket 80-90 rulemaking, the Commission converted the tables in Part 73 of the FCC Rules giving the length of one degree of latitude and one degree of longitude, as a function of latitude, from tabular form to the trigonometric power series that generated those tables.[1] Those formulas were, in turn, from *The American Practical Navigator* by Nathaniel Bowditch.[2] The use of formulas rather than look-up tables became practical with the wide availability of hand-held calculators and computer workstations that could easily and quickly perform the necessary mathematical calculations.

3. The formula approach worked so well that in the WT Docket 98-20 rulemaking, the Commission added a matching rule to Part 1, namely Section 1.958, *Distance Computation*. However,

[1] Section 73.208 of the FCC Rules, *Reference Points and Distance Computations.*
[2] Table 6, *Length of a Degree of Latitude and Longitude.*

an error was inadvertently introduced within the formula giving the length of 1° of longitude: The first term in the series should have been 111.41513cos(ML), where ML is the mid-latitude between two points whose distance is to be calculated, but was instead published as 111.41513cos(5ML).[3] Since this term was the first and most important in the series, it could cause a significant error.

4. The problem is more insidious than it might first appear, because first the rule *requires* use of the indicated formulas for distance calculations; its use is not voluntary. Second, because the technique considered the distance to be the hypotenuse of a right triangle whose sides are the D_{lat} and D_{long} lengths, and thus these terms were squared and added, the resulting calculation error was not obvious; that is, it did not give a result that was clearly incorrect, but rather a result that could be incorrect by a non-obvious, but still non-trivial, amount.[4] Third, the direction of the error changed as a function of the mid-latitude; that is, for some mid-latitudes, the distance was under-calculated, and for other mid-latitudes the distance was over-calculated. There were even two "sweet spot" mid-latitudes at which the errors cancel out. The attached Figure 1 shows the relationship.

5. When H&E discovered this clearly typographical error, we first informally attempted to have it corrected, but were advised by Commission staff that since the WT Docket 98-20 rulemaking had long been completed, the Administrative Procedures Act would not allow an informal correction of the formula. Accordingly, on March 21, 2011, H&E filed a formal Petition for Rulemaking to correct Section 1.958. The Commission subsequently issued the WT Docket 12-40 NPRM, where, at Paragraph 66, it proposed to correct the D_{long} formula.

II. Summary

6. Correction of the Section 1.958 D_{long} term from 111.41513cos(5ML).... to 111.41513cos(ML)... is in the public interest. H&E urges the Commission to adopt the proposed correction.

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[3] The first three terms of the series are D_{long} = 111.41513cos(ML) – 0.09455cos(3ML) + 0.00012cos(5ML), where D_{long} is the length in km of 1° of longitude at the mid-latitude between the two points.

[4] For example, the true distance between Station KGO-TV in San Francisco and Station KCRA-TV in Sacramento is 101.65 km, but using the incorrect Section 1.958 formula gives 119.68 km.

III. List of Figures

7. The following figures or exhibits have been prepared as a part of these WT Docket 12-40 comments:

1. Plot showing the distance calculation error range caused by the Section 1.958 formula error.

Respectfully submitted,

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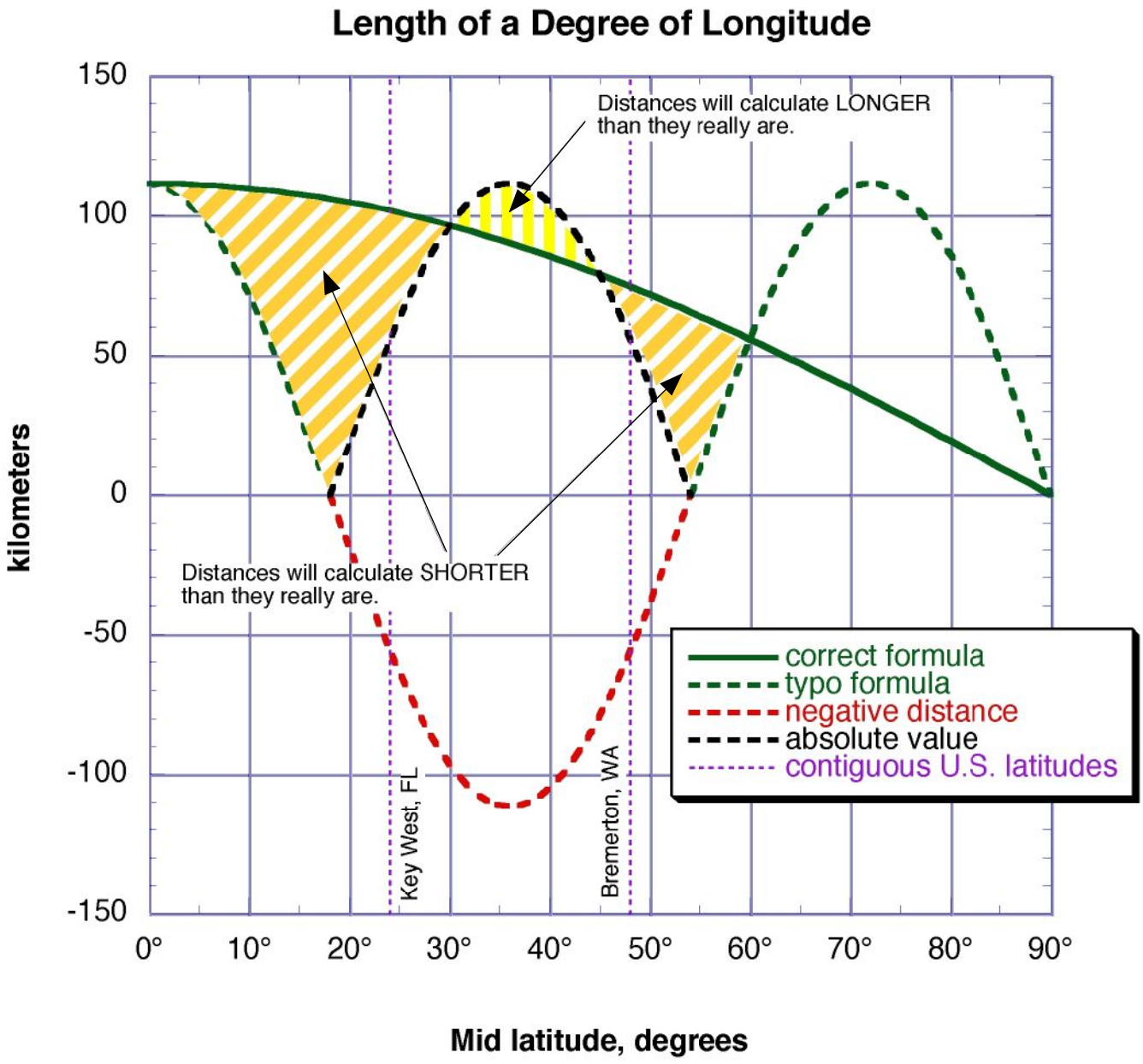
H&E Comments: WT Docket 12-40, Changes to the Part 22, 24 and 27 Rules

Distance Calculation Error Range Caused by the Section 1.958 Formula Error